2014

Proposition 39 Planning Document

East High School, CA

Sample Energy Evaluation Report

8/1/2014

SMARTWATT Energy Inc.®

Table of Contents

Figures

Tables

Appendices

1.0 Executive Summary

1.1 CCC Energy Corps Initiative: Partnership between CCC and SmartWatt Energy, Inc.

With funding opportunities from Senate Bill 73 - California Proposition 39, the California Conservation Corps (CCC) has launched the Energy Corps. The Energy Corps (Corps) consists of trained Corps members who perform site audits at no cost to the Local Education Agencies (LEAs) who need assistance with project planning.

For East High School, a team of seven on-site corps members collected information over a two week period in August, including building envelope details, a complete inventory of luminaries, plug loads per each room, and a list of mechanical equipment.

Working together with the Corps members, SmartWatt Energy Inc. (SmartWatt) has taken the collected information and developed energy savings calculations, identified potential utility incentives, and put together a planning document outlining 12 energy efficiency potential projects at East High School. As an industry leader in design-build energy projects, SmartWatt is committed to ensuring that the design intent of every project is focused on realistic, buildable, and sustainable solutions with bottom-line cost savings.

The following planning document meets all the California Energy Commission (CEC) requirements related to supporting documentation for Forms A & B, attached in ***Appendix A***, for releasing the requested Proposition 39 (Prop 39) funds:

- An ASHRAE Level II audit report compiled from the details of the CCC site audits
- High-level measure savings estimates, from the CEC calculator, California Public Utilities Commission (CPUC) approved tools, and engineering analysis
- Itemized inventories of energy using equipment for each site
- Building envelope sketches compiled from Corps member site visits

1.2 Potential Energy Efficiency Measures (EEM)

Twelve measures have been identified as potential retrofit opportunities eligible to receive Prop 39 funding. If implemented in tandem, the potential demand reduction is approximately 353 kW, with an associated energy savings of 929,309 kWh, or $123,000 in utility savings.

Table 1 – Potential EEM List

EEM #	Energy Efficiency Measure (EEM) Type	EEM Description	Annual Utility Savings ($)	Net Customer Cost (minus Incentives)	Simple Payback (Yrs)	SIR
HVAC Measures						
EEM # 1	HVAC	Centrifugal Chiller VFD	$32,071.13	$293,987	9.17	2.01
EEM # 2	HVAC	Chilled Water Supply Temp Reset	$9,381.86	$24,741	2.64	7.06
EEM # 3	HVAC	Water Side Economizer Retrocommissioning	$14,515.83	$36,616	2.52	7.39
EEM # 4	HVAC	Hot water loop pump motor VFD	$5,610.99	$74,053	13.20	1.07
EEM # 5	HVAC	DCV and VFD on Gym	$488.80	$8,401	17.19	0.82
EEM # 6	HVAC	DCV and VFD on Performing Arts Supply Fan	$488.80	$8,401	17.19	0.82
Lighting Measures						
EEM # 8	Lighting	Interior Lighting Retrofit	$41,083.11	$815,449	19.85	0.71
EEM # 9	Lighting	24/7 Safety Lights to 80% Dimming	$6,564.16	$25,549	3.89	2.02
EEM # 10	Lighting	Exterior Wall Packs - 175W MH to LED	$4,264.76	$99,487	23.33	0.60
EEM # 11	Lighting	Parking Lot Lights - 400W MH to LED	$1,667.54	$30,234	18.13	0.78
EEM # 12	Lighting	Interior LEDs Advanced Controls	$6,163.85	$259,139	42.04	0.18
Other Measures						
EEM # 7	Pumping	Pool Pump Motor VFD	$3,087.72	$33,857	10.96	1.29
		Totals	$125,388.56	$1,709,913	13.64	1.13

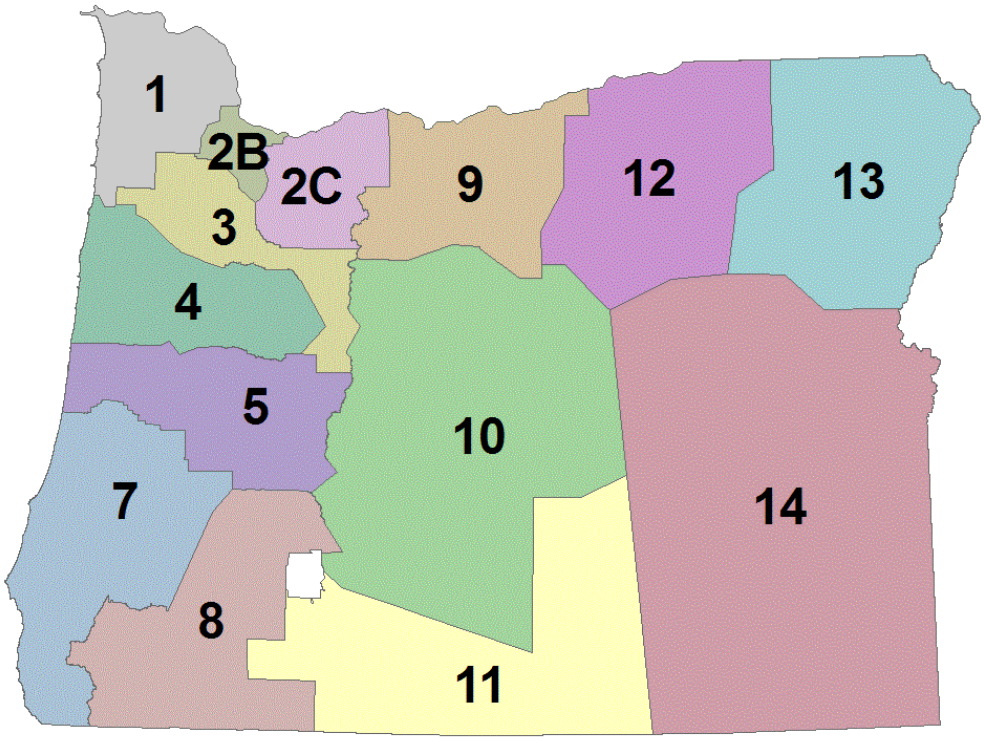
2.0 East High School

District Overview

The California Unified School District (CUSD) is a product of the unification of East Union High and West Elementary in 1989. The District currently has 11 schools spanning 110 square miles, including several cities and unincorporated areas.

CUSD currently operates 12 elementary schools (K-5), 2 K-8 schools, 4 middle schools (grades 6-8), 3 comprehensive high schools, 2 alternative high schools, and a K-12 online academy serving a total of more than 21,560 students. In additional to the traditional education model, the District also provides services to more than 800 special needs students, 1,000 adult education students and more than 1,000 students in the Early childhood Education and Intervention services. The District's revised operating budget for 2012/2013 is $154,041,191 million. The District is also one of the largest employers in the region, with more than 1,700 permanent employees.

Figure 1 - District Boundary Map



2.1 East High School

Overview

Based on the extensive and detailed data collected by the CCC Corps members, the approximate East High School energy end use breakdown is summarizes in Figures 2 & 3. The electrical energy breakdown is provided in ***Figure 2 – District Electric Energy by End Use***; and as expected, the major end users of electricity are the central plant, air conditioning equipment, and interior lighting. For the gas energy charted in ***Figure 4 – District Gas Energy by End Use***, space heating for the central plant and the energy required to heat the swimming pool throughout the year comprise the two major end uses.

Figure 2 - District Electric Energy by End Use

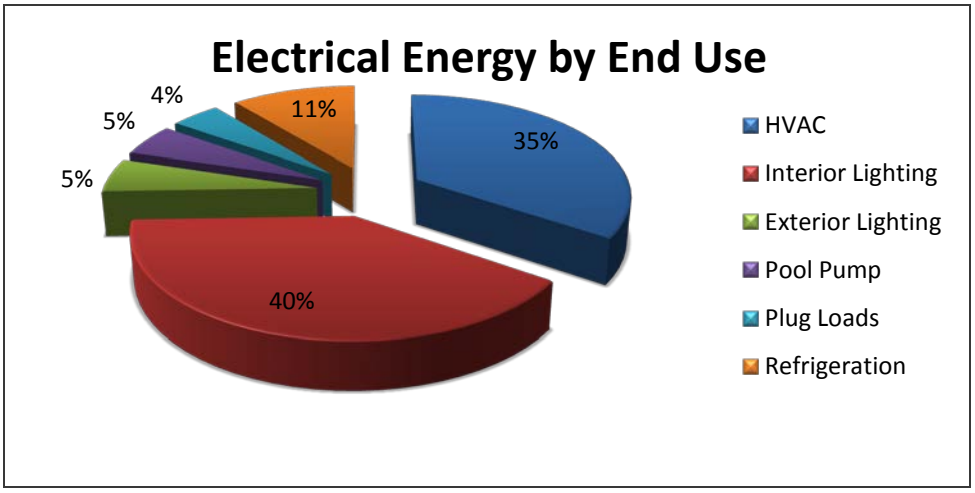
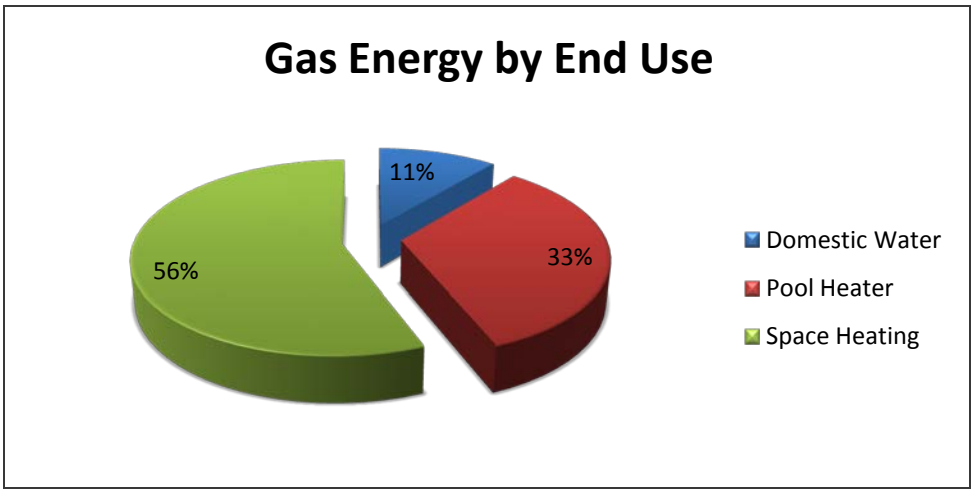


Figure 3 - District Gas Energy by End Use



East High School is a traditional grade 9-12 facility that was opened in 2004. The facility is comprised of seven buildings situated on a parcel of 39.2 acres. These buildings accommodate administration, a library/media center, classrooms, performing arts, a gymnasium, and an MPR/Kitchen area. The total building square footage is 284,519 square feet. Student enrollment for the 2012-2013 academic year was 1,600 students.

Figure 4 - Overview of East High Campus

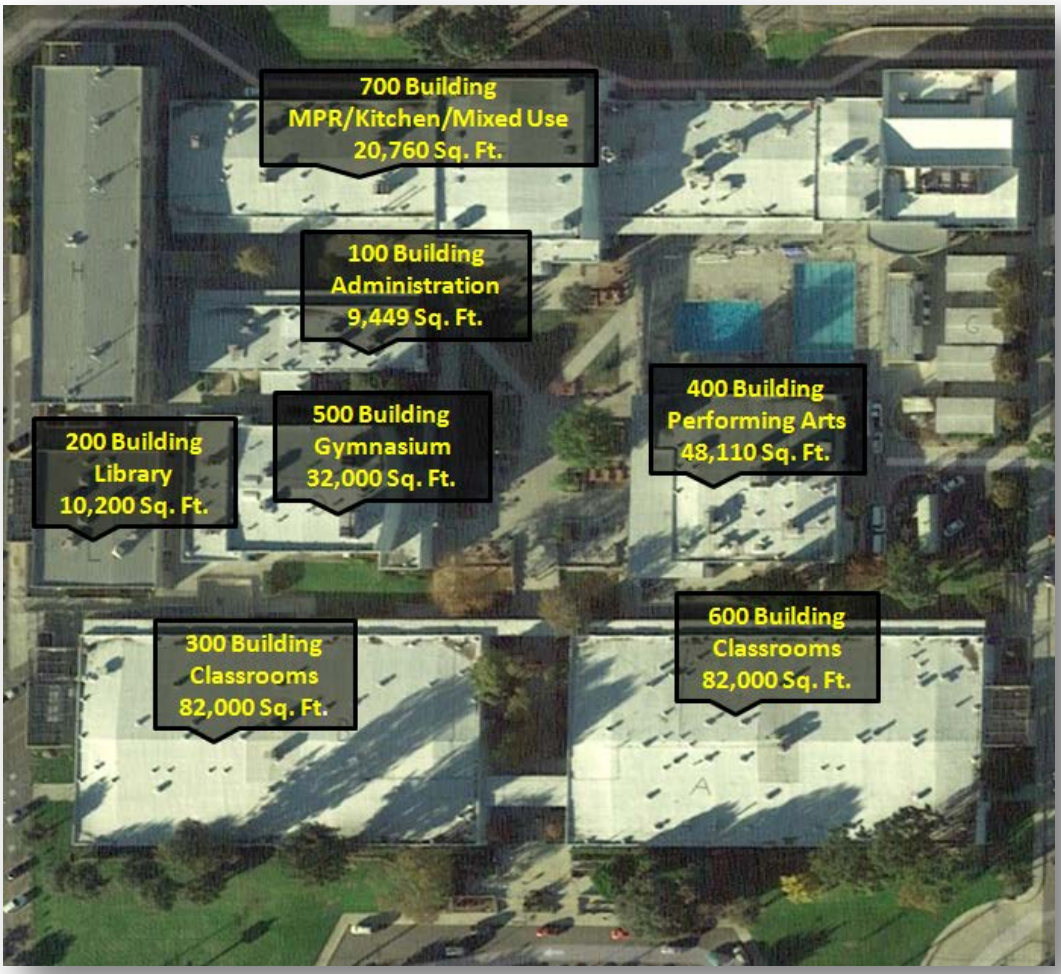


Table 2 – Campus Building Summary

Building Number	End Use	Build Date	Square Footage
100	Administration	2004	9,449
200	Library	2004	10,200
300	Classroom	2004	82,000
400	Performing Arts	2004	48,110
500	Gymnasium	2004	32,000
600	Classroom	2004	82,000
700	MPR and Kitchen	2004	20,760
	Total		284,519

Central Plant

The East High School campus is served by a central plant housing two 600-ton Carrier 19XR Evergreen Chillers and two Ajax gas-fired premix water heating boilers, rated at 3.486 MBtu max output each. The chilled water loop is a primary-secondary configuration. The primary pumps are constant speed 10 HP Bell and Gossett, with two 100 HP variable speed Bell and Gossett for the secondary loop. The heat rejection is handled by two induced draft Evapco cooling towers. The condenser water temperature is reset based on outdoor wet-bulb temperature and both tower fans are variable speed. One of the two cooling towers is tied to a water side economizer to provide cooling using heat transfer directly from the chilled water loop to the cooling tower when the outside air wet-bulb is low enough to facilitate the required thermal transfer. The plant is designed for a peak load fully occupied condition of 740 tons, but one chiller is manually off, and even during occupied times with high outside air temperatures the chiller tends to run only at part loads.

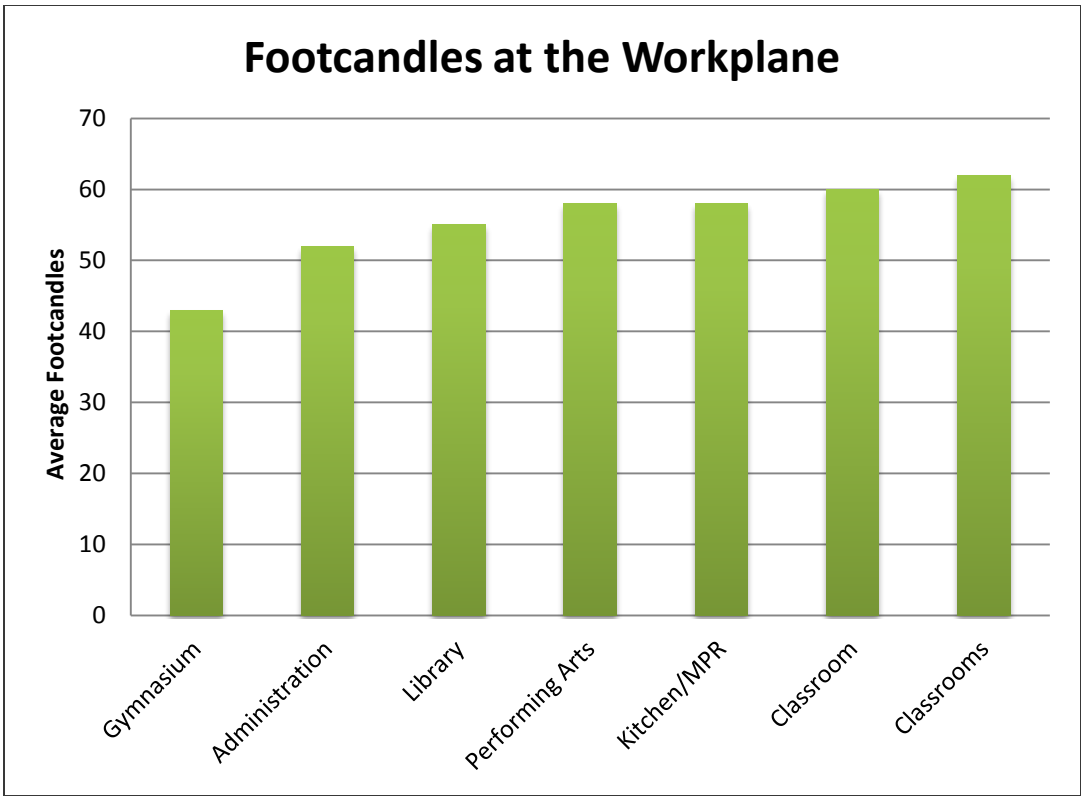
Figure 5 - Constant Speed Chiller at the East High Central Plant

Lighting

The primary interior illumination throughout the campus is provided by four-foot three-lamp T8 fluorescent fixtures. The light levels were measured by the CCC Corp members during their site visits. The average reading by building type is shown in Figure 5. The Illumination Engineering Society of North America (IESNA) recommends lighting levels between 30-50 foot candles at the work-plane. Because fluorescents are omni-directional, as opposed to LEDs, which are uni-directional, delivered light levels can usually be maintained at the same or greater levels post-retrofit, at a reduced input wattage.

Exterior lighting on the campus consists of 175 watt metal halide wall packs and 400 watt metal halide pole mount parking lot lights. The exterior lighting controls are photocells as well as limited EMS scheduling capabilities.

Figure 6 - Average Footcandles at the Work Plane



2.2 Building 100 – Administration

Figure 7 - Administration Building

The Administration Building is 9,449 square feet and houses private offices for the administrative staff, a small career interest center, a break room, copy room, and lobby/registration area.

Primary Energy Using Equipment and Controls

- 15 fan-coil units with a design capacity of 34 tons serve the building's HVAC requirements. The total supply fan power is approximately seven HP. Seven exhaust fans totaling less than 1 HP also serve the building.
- The space temperature is controlled at the zone level by Alerton thermostats, which allow the occupants to cool to 72 degrees and heat to 68 degrees. All of the fan coil units in Building A share the same schedule through centralized EMS and operate 7 a.m. – 5 p.m. with a two hour override capability.
- The interior illumination is provided by three-lamp 2x4 linear fluorescent troffers, with indirect lighting from metal halide fixtures in the hallways. There are also safety lights in each room or area which maintain 24/7 illumination. The lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two-lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.
- Computers and office equipment comprise the majority of the plug loads. Power strips are typical for clusters of equipment.
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Figure 8 - Exterior Wall Packs

2.3 Building 200 – East High Community Center

The East Community Center is 10,200 square feet campus library which has a joint-use agreement with the county. The building operates during normal school hours to accommodate educational activities, and then opens to the public from 3:00 p.m. to 8:00 p.m. on the weekdays. Weekend operation is from 10:00 a.m. to 6:00 p.m. on Saturdays, and 12:00 p.m. to 5:00 p.m. on Sundays.

Figure 9 - East High Community Center

Primary Energy Using Equipment and Controls

- HVAC is supplied by 13 fan coil units with a design capacity of 45 tons. The supply fan HP for the units totals approximately 8 HP.
- Due to the joint use scheduling, during non-school hours the library is often the only end user of the chilled or hot water. The constant speed chiller is required to satisfy the cooling loads at very low loads, causing poor kW/ton performance.
- The zone level temperature controls are Alerton thermostats which tie into the central EMS.

- The interior illumination is provided by three-lamp 2x4 linear fluorescent troffers, with indirect lighting from metal halide fixtures in the hallways. There are also safety lights in each room or area which maintain 24/7 illumination. The lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two-lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.
- Domestic hot water is provided by local gas-fired hot water heaters

2.4 Buildings 300 and 600 - Classrooms

Buildings 300 and 600 are identical 82,000 square foot facilities which house the campus classrooms. Both buildings have typical occupancy from 7:00 a.m.to 3:00 p.m., but have specific classrooms with zero and 8th period classes, requiring the schedules to range from 6:00 a.m. to 4:00 p.m. The building is scheduled such that each building comprises a zone. Individual classrooms do not have the capability to be scheduled separately at this time.

Figure 10 - Classroom Building

Primary Energy Using Equipment and Controls

- Each building is served by approximately 30 fan coil units. The architectural design of both buildings is identical. However, the cooling requirements are slightly different due to the classroom uses. Building 300 has a design capacity of 205 tons, while building 600 has a design capacity of 121 tons.

- The interior illumination is provided by three lamp 2x4 linear fluorescent troffers, with indirect lighting from metal halide fixtures in the hallways. There are also safety lights in each room or area which maintain 24/7 illumination. The lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two-lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.

Figure 11 - 24/7 Safety Lights

2.6 Building 400 – Performing Arts

Figure 12 - Performing Arts Building

The Performing Arts Building is a 48,110 square foot facility that houses a complete stage and audience seating area, a workshop designed to create props, as well as photography, filming, and video editing classroom space. The space is subject to varying hours of use. Cooling and heating water is supplied by the central plant. The building has been split into two separate zones such that the theater space can be scheduled separately from the classroom areas. The operating hours are 7:00 a.m. to 3:00 p.m. daily with special events and performances scheduled on weekends and Friday evenings.

Primary Energy Using Equipment and Controls

- 23 fan coil units and four air handlers with a total design capacity of 121 tons serve the performing arts center. The air handlers serve the lobby, stage, and patron seating area.
- The stage area has performance lighting used during theater events.
- The interior illumination is provided by three-lamp 2x4 linear fluorescent troffers. There are also safety lights in each room or area which maintain 24/7 illumination. The lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two-lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.
- The classrooms areas have a substantial quantity of video editing, filming equipment, and computer labs.

2.7 Building 500 – Gym

Figure 13 - Gym

The Gym is a 32,000 square foot containing a main gym, an auxiliary gym, a weight room, locker rooms, and various classrooms. The building has been split into two separate zones such that the gym areas can be scheduled for events separately from the classroom areas. The daily operating hours are 7:00 a.m. to 3:00 p.m. with special events, practices and games taking place on weekends and evenings.

Primary Energy Using Equipment and Controls

- 16 fan coil units and five air handlers with a total design capacity of 205 tons serve the Gym. The air handlers serve the athletic areas and lobby.
- The gyms are illuminated by eight-lamp high bay 42 watt CFL fixtures.
- The interior illumination is provided by three lamp 2x4 linear fluorescent troffers. Excluding the gyms, there are also safety lights in each room or area which maintain 24/7 illumination.
- Interior lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.

2.8 Building 700 – Kitchen and Multipurpose Room

Figure 14 - Kitchen and MPR

The Kitchen/MPR building is a 20,760 square foot building that houses the kitchen area, a staff café, and a large café that's also used as a multi-purpose room. The daily operating hours are 7:00 a.m. to 3:00 p.m. with special events taking place on weekends and evenings.

Primary Energy Using Equipment and Controls

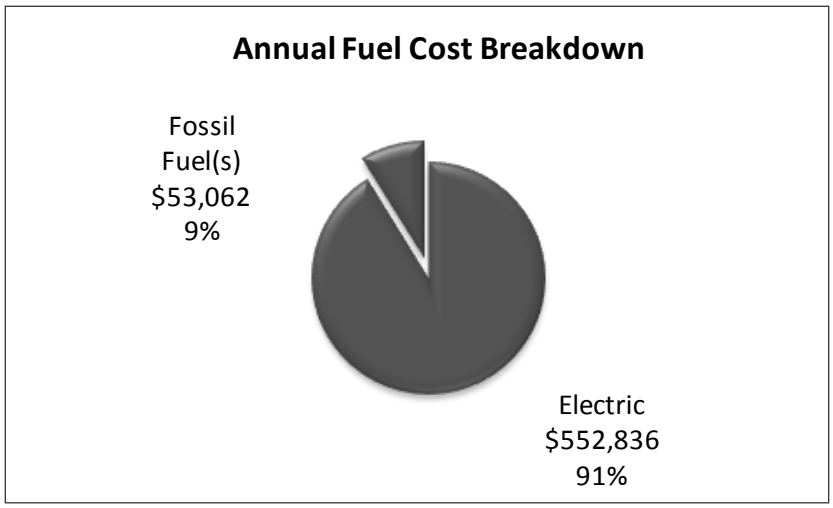
- 12 fan coil units and five air handlers with a total design capacity of 75 tons serve the Kitchen and Cafeteria Areas.
- The interior illumination is provided by three-lamp 2x4 linear fluorescent troffers. There are also safety lights in each room or area which maintain 24/7 illumination.
- Interior lighting controls are bi-level wall switch, allowing the room to be illuminated with one lamp per fixture, two-lamps per fixture, or all three for full light output.
- The exterior illumination is provided by 175 watt metal halide wall-packs. Exterior lighting has been tied in to the central EMS system for scheduling.

3.0 Utility Data Analysis

3.1 Utility Information Summary

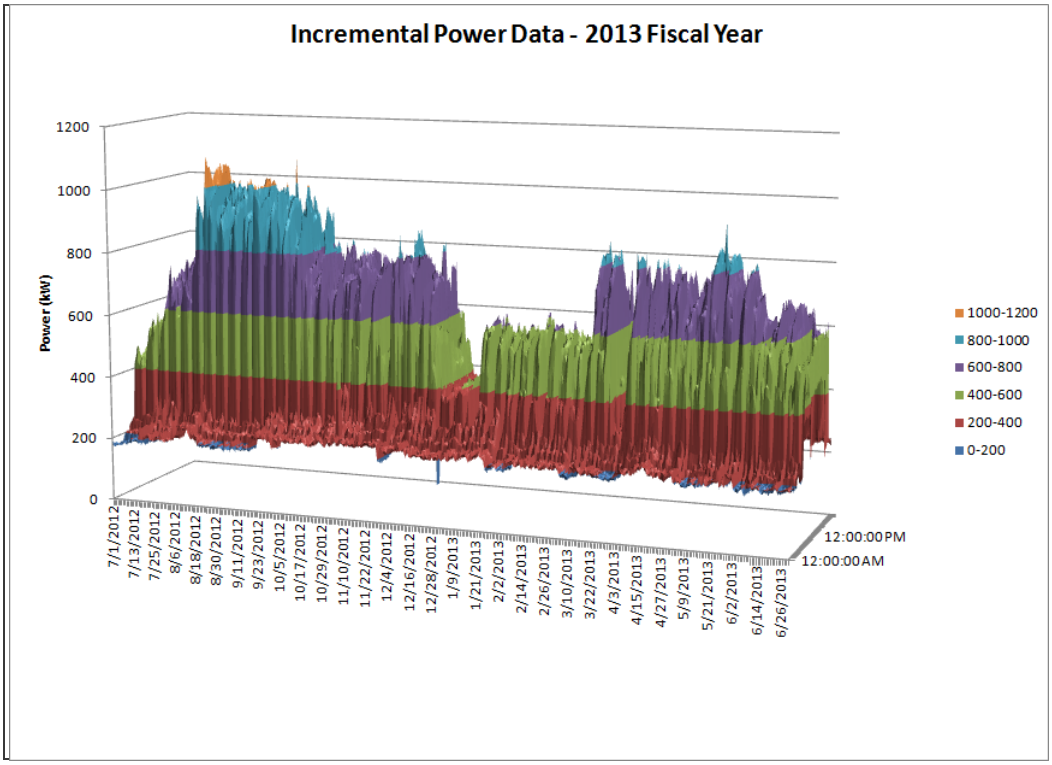
The California Unified School District receives electricity from Southern California Edison and natural gas from Southern California Gas (SoCal Gas). As shown in ***Figure 15 – Annual Fuel Cost Breakdown*** 91% of the energy used is electricity, with the remaining 9% comprised of natural gas usage. Water is purchased from California Municipal Water District.

Figure 15 - Annual Fuel Cost Breakdown



As part of your planning document requirements, SmartWatt collected 12 months of utility billing data and conducted a thorough analysis. The annual profile of the CUSD's fiscal year is shown in ***Figure 16 – Annual Incremental Power Data***. The X-axis represents an individual day, the Y-axis showing hours of the day, and the Z-axis the instantaneous building load. The base load for the district is approximately 200 kW. The seasonal profiles correspond to breaks and summer seasons. As a high school, even during unoccupied periods Lakeside shows a significant electrical load. This is attributable in part to the Library Building which is served by the central plant. On weekends and breaks the library continues to operate and requires running the central plant.

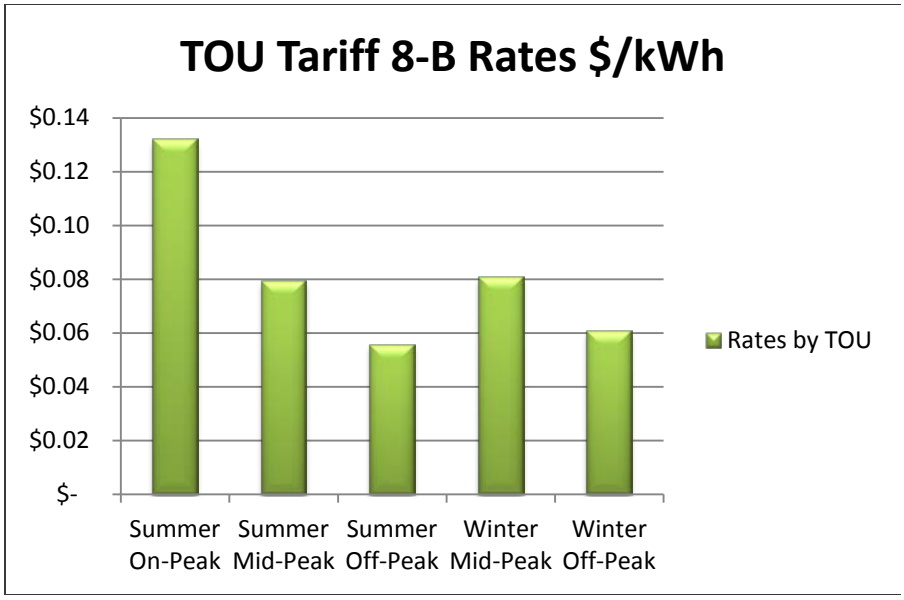
Figure 16 - Annual Incremental Power Data



3.2 Rate Analysis

Properly calculating unit cost of energy is an extremely important component to calculating energy cost savings. The table below details this cost by facility, which is used to convert energy savings into cost savings.

Figure 17 - East High TOU Breakdown



4.0 Facility Benchmarking

4.1 Energy Use Index (EUI)

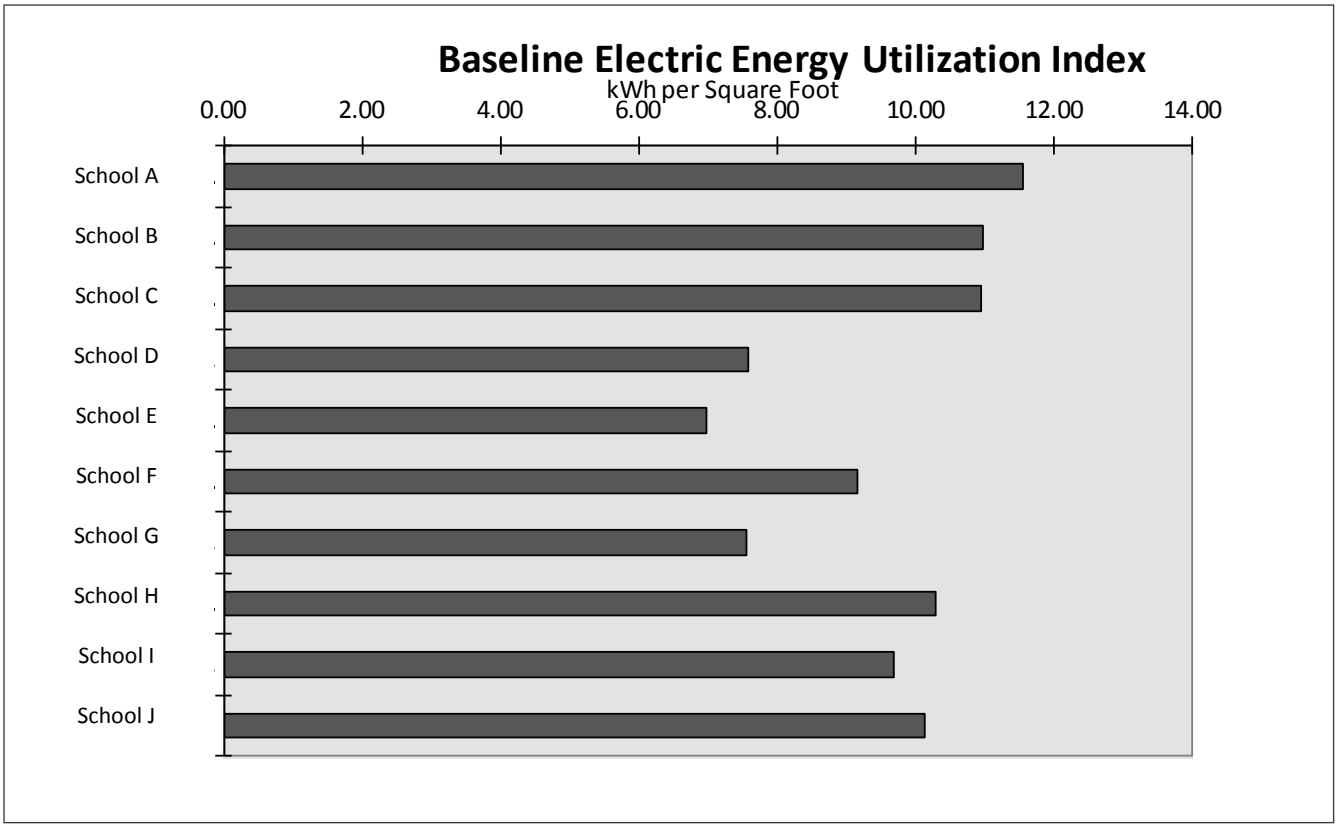
Benchmarking is a useful way to compare energy use among peer buildings. The total energy is averaged across the building square footage on an annual basis. This comparison tool allows building managers to prioritize energy projects based on an objective normalized approach. Additionally, it can be an insightful way to assess energy usage among peer buildings nationwide.

EnergyStar maintains a database of energy usage statistics for different building types, compiled from data collected every four years by the Energy Information Administration. The data is specific to building type and is included in the benchmarking assessment.

Table 3 – Baseline Energy Utilization Index

Metric	Baseline (May 2013)	Current (Mar 2014)	Target	Median Property
ENERGY STAR score (1-100)	67	68	85	50
Source EUI (kBtu/ft^2)	151.4	145.6	119.8	171.2
Site EUI (kBtu/ft^2)	64.0	61.8	50.8	72.6
Source Energy Use (kBtu)	48,993,024	47,127,374	38,788,972.3	55,412,817
Site Energy Use (kBtu)	20,712,113	19,987,838	16,449,061	23,498,659
Energy Cost ($)	$559,537	$607,412	$499,872.43	$714,103
Total GHG Emissions (Metric Tons CO_2e)	1,553.2	1,496.3	1,231.4	1,759.1

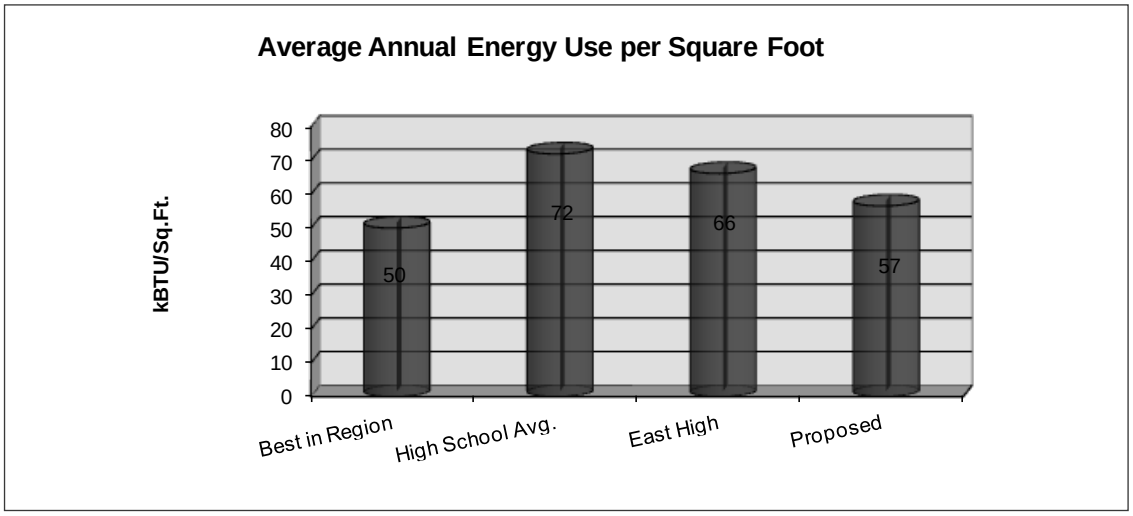
Figure 18 - Baseline EUI by School



4.2 Energy Use Index versus Comparables

Comparing facility EUI performance versus the performance of other similar buildings is a great way to rate facility's energy efficiency performance.

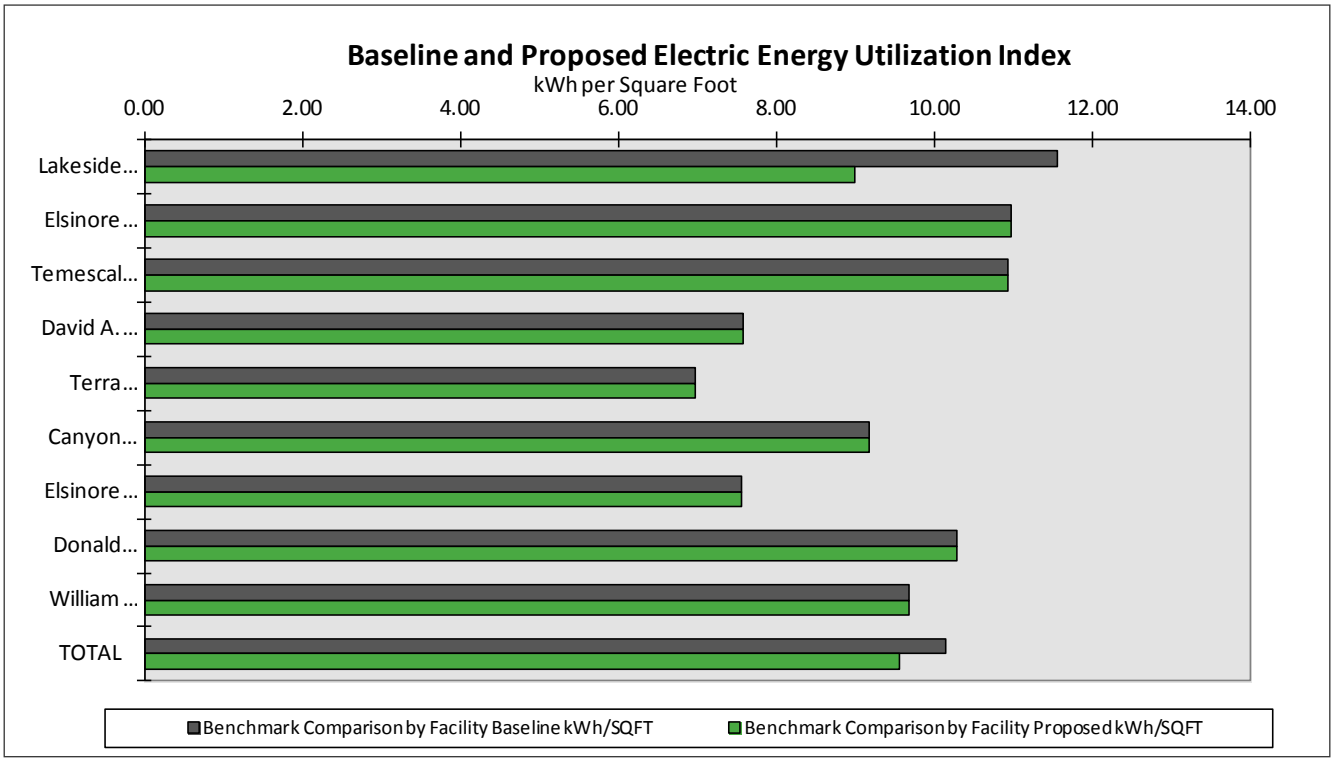
Figure 19 - Average Annual Energy Use Intensity



4.3 Energy Use Index (Baseline vs. Proposed)

The graph below shows the combined electric and fuel kBTU per square foot for each facility in both the baseline (existing) case and the proposed (post upgrade) case.

Figure 20 - Baseline and Proposed Fuel Usage



5.0 Findings and EEMs

5.1 Lighting

EEM 1.0 – Interior Lighting Retrofit

East High is illuminated primarily by four-foot three-lamp fluorescent T8s. The illumination levels are in accordance with IESNA standards; and the baseline watts/square footage is approximately 1.2 for most areas. Retrofitting the fluorescent fixtures with LEDs will save approximately 50% of the nominal input wattage while maintaining the required light levels.

Calculation Methodology & Utility Incentives

The energy savings were estimated using the room by room lighting survey provided by the CCC. The run hours are based upon 185 ten-hour run-time occupied days per year, and 60 four-hour unoccupied days per year. A diversity factor of 70% was incorporated into both the demand reduction and the energy savings. The savings estimates are expected to lower on the conservative side. SCE provides an installation incentive of $0.08/kWh saved and $100/kW peak demand reduced for DLC approved LED fixture replacements.

Results

Table 4 – EEM-8 Interior Lighting Retrofit

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Interior Lighting Retrofit	122.35	255708.1435	$ 19,259.39	0.00	0	$41,083.11	$815,449

EEM 2.0 – 24/7 Safety Lights to 80% Dimming

East High has at least one light fixture that operates 24/7 in every room on campus. These fixtures are a prime candidate for an advanced controls retrofit. The fixtures should operate based on occupancy. If the area is unoccupied the light output should be limited to 20%. This still provides the illumination necessary to see the space, and walking through an area will bring the safety fixtures back to full illumination.

Calculation Methodology & Utility Incentives

Savings for the safety light dimming measure were estimated assuming that 10% of the fluorescents are safety lights, and assumes a diversity factor of 60% for occupied times. The nominal input power for unoccupied times was taken as 80% of nominal, although this ratio is field adjustable.
SCE provides an installation incentive of $0.08/kWh saved and $100/kW peak demand reduced for LED retrofit measures. However, due to new Title 24 requirements, the occupancy-based savings are excluded from the incentive calculation.

Results

Table 5 – 24/7 Safety Lights to 80% Dimming

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
24/7 Safety Lights to 80% Dimming	5.77	73492.93	$ 5,535.33	0.00	0.00	$6,564.16	$25,549

EEM 3.0 – Exterior Wall Packs – 175W MH to LED

Lakeside High School currently has approximately 105 175-watt metal halide wall packs throughout the campus. It is recommended to retrofit the wall pack fixture with LEDs.

Calculation Methodology & Utility Incentives

The total fixture count per building was taken from the detailed energy survey results provided by the CCC. Energy savings are calculated using the net reduction of input power per fixture, multiplied over 4,100 hours of nighttime exterior operation, as established by DEER. SCE provides an installation incentive of $0.08/kWh saved for LED retrofit measures.

Results

Table 6 – Exterior Wall Packs to LED

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Exterior Wall Packs - 175W MH to LED	-	56,624	$ 4,264.76	0.00	0.00	$4,264.76	$99,487

EEM 4.0 – Parking Lot Lights – 400W MH to LED

Exterior parking areas are illuminated by 20 pole-mount 400 watt metal halide fixtures. It is recommended to retrofit the parking lot fixtures with LEDs capable of providing the same illumination at a reduced nominal input wattage.

Calculation Methodology & Utility Incentives

The total fixture count per parking area was taken from the detailed energy survey results provided by the CCC. Energy savings are calculated using the net reduction of input power per fixture, multiplied over 4,100 hours of nighttime exterior operation, as established by DEER. SCE provides an installation incentive of $0.08/kWh saved for LED retrofit measures.

Results

Table 7 – Parking Lot Metal Halide to LED

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Parking Lot Lights - 400W MH to LED	-	22,140	$ 1,667.54	-	0.00	$1,667.54	$30,234

5.2 Controls

EEM 5.0 – Interior LEDs Advanced Controls

The post-retrofit interior LEDs are well suited to a variety of advanced controls options. LEDs respond well to daylight harvesting, dimming, and occupancy-based controls.

Calculation Methodology & Utility Incentives

The energy savings for the advanced controls are estimated at 15% of the post retrofit baseline. This is a very conservative estimate based upon the utility program requirements. Actual savings will be based upon monitored baseline and post-implementation results.

Due to the new Title 24 requirements, day lighting and occupancy-based controls are no longer eligible for incentives.

Results

Table 8 – Interior LEDs Advanced Controls

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Interior LEDs Advanced Controls	18.4	38,356	$ 2,888.91	-	0.00	$6,163.85	$259,139

5.3 HVAC

EEM 6.0 – Centrifugal Chiller VFD

Reducing the flow through a centrifugal pump or fan decreases the required power input by a cubic relation, meaning that the same 10 percent reduction in flow will result in a power input of approximately (1 - 0.9^3) = 73%; a 27% power reduction.

East High currently has two Carrier XR19 600-ton constant speed chillers. It is recommended that at least one of the chillers be retrofit with a VFD. The control sequence will be such that a single chiller

with VFD will handle partial loading scenarios. As the capacity of the chiller is reached, the constant speed chiller will become the lead and the VFD chiller the trim.

Calculation Methodology & Utility Incentives

Preliminary calculations were performed using the SCE Online Application Tool, which is an Engage-based CUPC approved tool developed by Southern California Edison as a method for customers to estimate energy savings. The savings calculations are expected to err on the conservative side and will be modified based upon the results of the investment grade audit effort.

Results

Table 9 - EEM-1 Centrifugal Chiller VFD

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Centrifugal Chiller VFD	89.4	214,072	$ 16,123.46	0.00	0	$32,071.13	$293,987

EEM 7.0 – Chilled Water Supply Temp Reset

Chilled water systems are commonly designed to provide full cooling load with a chilled water temperature of 44°F, which is left as a constant throughout the year. However, chillers operate more efficiently at higher leaving water temperature. In general, efficiency increases as the chilled water supply temperature is raised. Where all zones are controlled by direct digital controllers (DDC), the optimal reset strategy is based upon valve position, where the CHWST is reset until the valve controlling the coil that requires the coldest water is wide open. This ensures that all the remaining zones will be able to satisfy the space requirements. Typically, it is possible to raise the chilled water temperature by 5°F to 10°F for much of the time.

Calculation Methodology & Utility Incentives

Preliminary calculations were performed using the SCE Online Application Tool, which is an Engage-based CUPC approved hourly calculation tool developed by Southern California Edison as a method for customers to estimate savings. The energy savings calculations are expected to err on the conservative side and will be modified based on the results of the investment grade audit effort.

Results

Table 10 – EEM-2 Chilled Water Supply Temperature Reset

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Chilled Water Supply Temp Reset	30.2	53,075	$ 3,997.48	0.00	0	$9,381.86	$24,741

EEM 8.0 – Water Side Economizer Retrocommissioning

East High utilizes a flat plate heat exchanger connected to both the chilled water and condenser water loops by diverting valves that bypass the chiller. The chiller and condenser water is diverted past the chiller to the heat exchanger when the outside air wet bulb temperature is low enough that the cooling tower can produce condenser water at a temperature that is low enough to cool the water in the chiller loop to a temperature sufficient for cooling. This temperature can often be as high as 55 °F. Water side economizers can save significant chiller energy in the shoulder months. However, the water side economizer in the chilled water plant is offline and needs retrocommissioning work to get it back into service.

Figure 21 - Water Side Economizer Pump

Calculation Methodology & Utility Incentives

Preliminary calculations were performed using the SCE Online Application Tool, which is an Engage-based CUPC approved hourly calculation tool developed by Southern California Edison as a method for customers to estimate savings. The energy saving calculations are expected to err on the l conservative side and will be modified based upon the results of the investment grade audit effort.

Results

Table 11 – EEM-3 Water Side Economizer RCx

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Water Side Economizer Retrocommissioning	45.0	86,155	$ 6,489.03	0.00	0.00	$14,515.83	$36,616

EEM 9.0 - Hot water loop pump motor VFD

The two boilers serving the central plant employ constant speed hot water pumps that circulate the water through the building loop. The boilers are piped in parallel and operate on local controls. The lead boiler is set to fire when the circulating loop drops to 170˚f, with the second boiler firing if the circulating loop drops to 165˚f. The building loop is maintained at 140˚f. The circulating loop will mix hot water into the building loop to maintain the 140 degree set-point.

By adding a differential pressure sensor to the hot water loop at the farthest fan coil, and maintaining the pressure required to move the hot water through the control valve and coil, the variable frequency drive on the hot water pump motor will match the system requirements. As space temperatures are met and heating control valves close, the differential pressure increases, allowing the pump to slow down.

Calculation Methodology & Utility Incentives

Preliminary calculations were performed using the SCE Online Application Tool, which is an Engage-based CUPC approved hourly calculation tool developed by Southern California Edison as a method for customers to estimate savings. The energy savings calculations are expected to err on the conservative side and will be modified based on the results of the investment grade audit effort.

Results

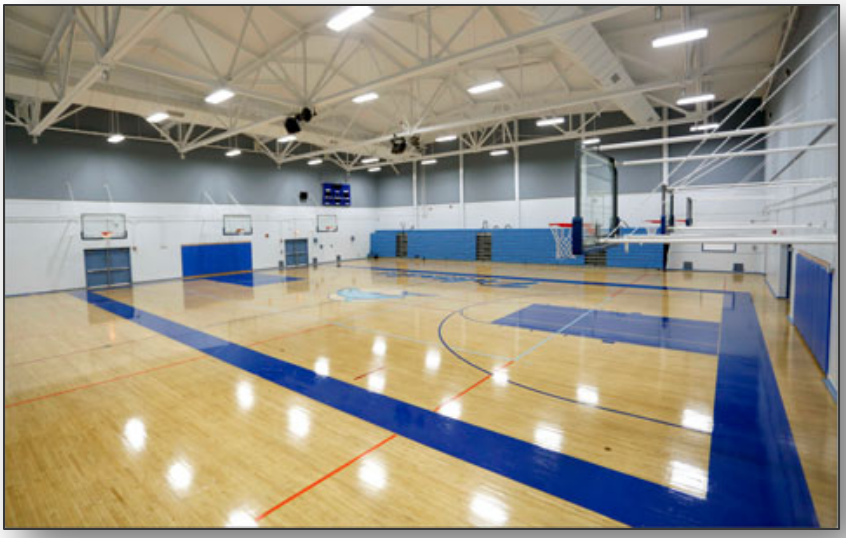
Table 12 – EEM-4 Hot Water Loop Pump Motor VFD

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Hot water loop pump motor VFD	-	74,498	$ 5,610.99	0.00	0.00	$5,610.99	$74,053

EEM 10.0 - DCV and VFD on Gym

The Athletic Center has two primary air handling units serving the open gym areas. The first is capable of delivering approximately 60 tons of cooling via a 15 HP supply fan serving the main gym. The second is a 30 ton unit with a 7.5 HP supply fan serving the auxiliary gym. Both units are constant volume air handlers controlled by space temperature, serving spaces with transient occupancy. It is recommended to retrofit the supply fan of the two air handlers with VFDs and incorporate demand control ventilation. During periods of low occupancy, the CO_2 levels will be below an 800ppm differential, allowing the supply fans to reduce the airflow supplied to the space. The savings will result from the reduction in fan speed during low occupancy as well reducing the cooling energy required to cool the outside air brought into the space.

Figure 22 - East High Auxiliary Gym



Calculation Methodology & Utility Incentives

Preliminary energy savings calculations were performed using the SCE Online Application Tool, which is an Engage-based CUPC approved hourly calculation tool developed by Southern California Edison as a method for customers to estimate savings. The calculations are expected to err on the conservative side and will be modified based on the results of the investment grade audit effort.

Results

Table 13 – EEM-5 DCV and VFD on Gym AHU

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
DCV and VFD on Gym	1.3	3,357	$ 252.81	0	0.00	$488.80	$8,401

EEM 11.0 - DCV and VFD on Performing Arts Supply Fan

The Performing Arts Center has two air handling units serving the theater area. The first is capable of delivering approximately 45 tons of cooling via a 10 HP unit serving the auditorium area. The second is a 22 ton unit with a five HP unit serving the stage. Both units are constant volume air handlers controlled by space temperature. It is recommended to retrofit the supply fan of the two air handlers with VFDs and incorporate demand control ventilation. During periods of low occupancy, the CO_2 levels will be below an 800ppm differential, allowing the supply fans to reduce the airflow supplied to the space. The savings will result from the reduction in fan speed during low occupancy as well reducing the cooling energy required to cool the outside air brought in to the space.

Figure 23 - Theater Air Handler

Calculation Methodology & Utility Incentives

Preliminary calculations were performed using the SCE Online Application Tool, which is an Engage based CUPC approved hourly calculation tool developed by Southern California Edison as a method for customers to estimate savings. The energy savings calculations are expected to err on the conservative side and will be modified based on the results of the investment grade audit effort.

Results

Table 14 – DCV and VFD on the Theater AHU

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
DCV and VFD on Performing Arts Supply Fan	1.3	3,357	$ 252.81	0	0.00	$488.80	$8,401

5.5 Other Measures

EEM 12.0 - Pool Pump Motor VFD Description

Commercial pool systems are required by the health department to turn over the volume of water once every six hours. The pumps required to accomplish the required turnover are sized based upon worst case pressure drop over the system, occurring at the end of the filter cleaning cycle, and also incorporate a safety factor. Installing a flow sensor which relays information to a variable frequency drive on the pump motor allows the system to maintain the required flow, but allows the pump speed to modulate based upon the system pressure. This sequence captures energy savings during periods of less than maximum pressure.

Calculation Methodology & Utility Incentives

The energy savings for this measure were calculated using short term monitoring of the pool pump motor. The maximum pump power was correlated to the design flow rate to match the pressure drop of the system. A typical pressure variation for the cleaning cycle of commercial sand filters was used to estimate the pump speed reduction potential.

Figure 24 - Constant Speed Pool Pump

Results

Table 15 – EEM-7 Pool Pump VFD

Energy Efficiency Measure	Demand Savings (kW)	Electricity Savings (kWh/yr)	Electricity Cost Savings ($/yr)	Natural Gas or Fuel Savings (therms or gal/yr)	Natural Gas or Fuel Cost Savings ($/yr)	Annual Cost Savings	Installed Measure Cost
Pool Pump Motor VFD	3.7	32,257	$ 2,429.52	0.00	0	$3,087.72	$33,857

6.0 Energy Project Tracking and Reporting

According to the Prop 39 guidelines, LEA's are required to submit an annual progress status report for each approved energy expenditure plan to the CEC, until all projects within the plan are completed. Public Resources Code Section 26240(b)(1-7) requires that to the extent practical, this report contain information on the following:

- The total final gross project cost before deducting any incentives or other grants and the percentage of total project cost derived from the Job Creation Fund.
- The estimated amount of energy saved, accompanied by specified energy consumption and utility bill cost data for the school or site where the project is located. The nameplate rating of new clean energy generation installed.
- The number of trainees.
- The number of direct full\time equivalent employees and the average number of months or years of utilization for each of these employees.
- The amount of time between awarding of the financial assistance (that is, receiving the approved energy expenditure plan award deposit) and the completion of the project or training activities.
- The facility's energy intensity before and after project completion, as determined from an energy rating or benchmark system.

Persistence of energy for all savings from implemented measures is an aftercare service that SmartWatt provides for all projects. SmartWatt will develop a comprehensive report addressing each of the seven components detailed above Prop 39 projects. Additionally, for districts which currently are in contract with a shared savings energy conservation company, International Measurement and Verification Protocol (IMVP) Option A or Option B will be used to isolate energy savings resulting from Prop 39 Projects. This ensures that the District will receive full credit for all capital projects undertaken outside the scope of an energy conservation program.

7.0 Project Financials

7.1 Estimated Project Cost

SmartWatt has developed project cost estimates based upon site walks, information collected by the CCC, and best project engineering practices. The estimated costs are useful for prioritizing projects by their expected payback, and it is expected that the accuracy of the estimated costs is

7.2 Utility Incentives

The utility incentives were estimated based upon Southern California Edison's Custom Incentive and HVAC Optimization Programs. Estimated additional incentives from SoCal Gas were also identified to help offset costs. SmartWatt will guarantee incentives for this project pursuant to the utility's rebate application approval process and approval of this proposal within a 90-day time period. Furthermore, if the customer chooses, SmartWatt will have the incentive paid directly from the utility to SmartWatt, effectively lower the out-of-pocket investment by the District.

7.3 Cash Flow Summary

The cash flow table provides a financial analysis for the Phase 1 projects with our proposed funding option.

Figure 25 - Pro Form 1

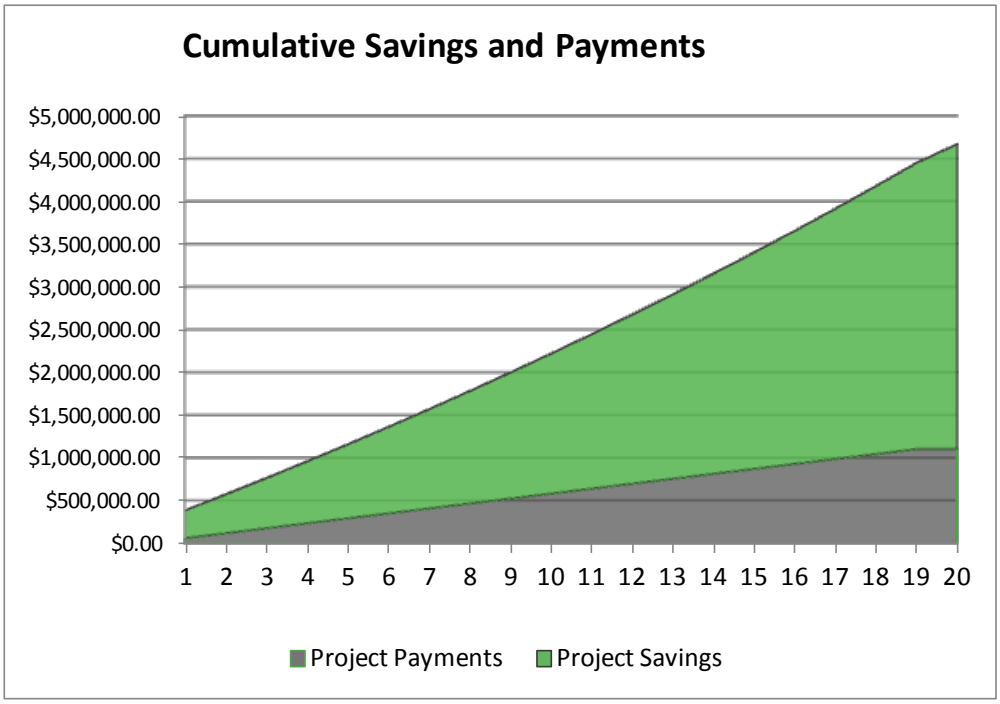
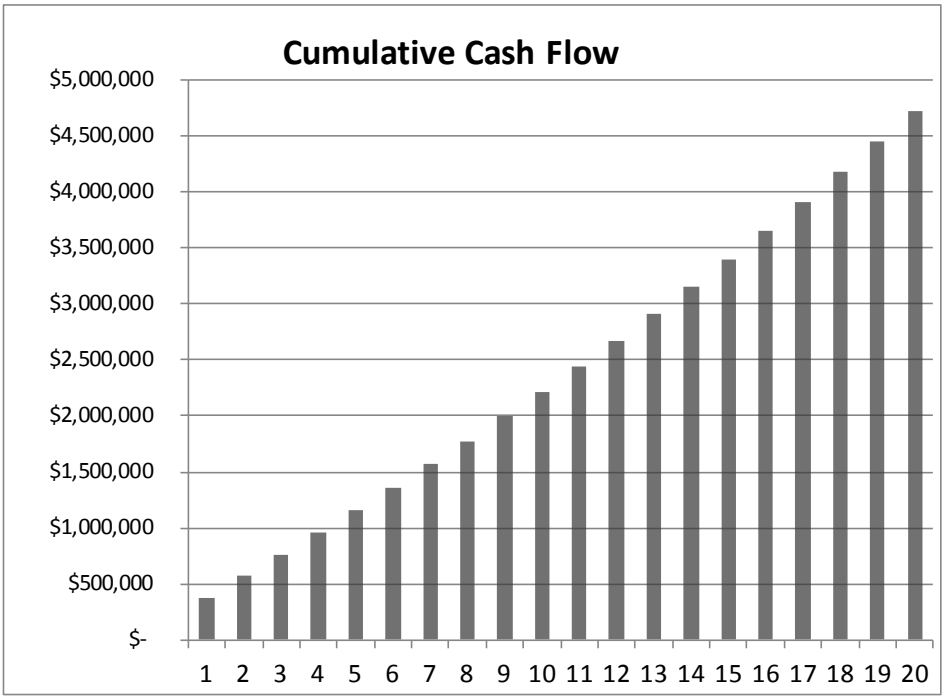


Figure 26 - Pro Form 2



Prop 39 Planning Document Appendices

East High School, CA
Sample Energy Evaluation Report

Appendix 1: Expenditure Plan General Form A
Appendix 2: Expenditure Plan Project Summary Form B
Appendix 3: Equipment List
Appendix 4: Calculation Files

Appendices 1-4

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